

Bonn. zool. Beitr.	Bd. 44	H. 1–2	S. 33–40	Bonn, August 1993
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The genus *Roederiodes* Coquillett, 1901 (Diptera, Empididae: Clinocerinae) in Europe, with descriptions of four new species

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Abstract. A revision of the European species of the genus *Roederiodes* Coquillett, 1901 made evident, that *Clinocerella* Engel, 1918 described as a subgenus of *Wiedemannia* Zetterstedt, 1838 is a junior synonym (syn. n.) of *Roederiodes*. Both European taxa of *Clinocerella* fall into the range of variation within *Roederiodes*, which includes the differences among both genera mentioned by Engel. The following species are described and figured: *R. macedonicus* sp. n., *R. montenegrinus* sp. n., *R. siveci* sp. n. and *R. gereckeii* sp. n. The phylogenetic relationships of these new species and their ecology are discussed, and a key to adult males of all known European species and a world list of the genus are provided.

Key words. Diptera, Empididae, *Roederiodes*, taxonomy, Europe.

Introduction

The genus *Roederiodes* was described by Coquillett (1901) for the type-species *R. junctus* Coquillett, that occurs in North America. A second species, *R. longirostris* from Madeira was described by Frey (1940). In 1961, Chillcott added another five new Nearctic species: *R. distinctus*, *R. recurvatus*, *R. retroversus*, *R. vockerothi* and *R. wirthi*. In 1966, the same author added *R. petersoni* from the USA to the list. *R. japonicus* was described by Saigusa (1963) from the Island of Kyushu. Another European taxon for the genus, *R. malickyi* was described by Wagner (1981) from Greece (Crete). In 1981, Wilder described *R. wigginsii* from Costa Rica and placed *R. retroversus* (Chillcott, 1961) as a junior synonym of *R. wirthi* (Chillcott, 1961).

While studying abundant material of aquatic dance flies in the Slovene Museum of Natural History in Ljubljana and at the Limnologische Flußstation des Max-Planck-Instituts für Limnologie in Schlitz, we found that in contradiction to the statement of Engel (1940) at least close relations should exist between the taxa of *Roederiodes* Coquillett, 1901, and *Clinocerella* Engel, 1918. A revision of the European taxa thus became necessary in addition to the description of new species and information about the ecology of the species. The terminology of the taxonomic features of the male genitalia is based on the publication of Ulrich (1972).

Material and methods

Specimens were preserved in approx. 80 % ethanol. For inspection of the genitalia abdomens were removed and boiled in hot 10 % KOH until they became translucent. They were then transferred into acetic acid (96 %), thereafter into a mixture of acetic acid/clove oil (1 : 1) and then were put into pure clove oil. Figures were made with a LEITZ Dialux 20 EB, at 100x magnification, using a drawing mirror. Abdomens with genitalia are stored with the remaining

specimen in ethanol. The type material is deposited in the R. Wagner Collection (WAGC), Limnologische Flußstation Schlitz, Germany, and the Slovene Museum of Natural History (SMNH), Ljubljana, Slovenia.

Results

During the study of new European taxa the close affinities of *Clinocerella* and *Roederiodes* became evident. In 1940, Engel had mentioned the close affinities of both taxa, but mentioned a difference among both: *Clinocerella* should lack the possession of two kinds of setae on the costal vein. However, the study of the holotype of *C. sorex* Engel, which is the type-species of *Clinocerella*, and of abundant material of *C. oldenbergi* Engel made clear, that this difference does not exist. Based on this information we thus provide the following synonymy.

Roederiodes Coquillett

Roederiodes Coquillett, 1901. Bulletin of the New York State Museum 47: 585. (Type-species: *R. juncta* Coquillett, 1901. l. c., 585 (by monotypy).

Clinocerella Engel, 1918. Deutsche entomologische Zeitschrift 1918: 14 and 238 (as subgenus of *Atalanta* Meigen 1800). Type-species: *Atalanta (Clinocerella) sorex* Engel, 1918 (by original designation), syn. n.

Recognition

The similarity of *Roederiodes* Coquillett, 1901, and certain taxa of *Wiedemannia* Zetterstedt, 1838, is superficial. The best features to distinguish *Roederiodes* from all other Palaearctic genera are the elongate head capsule, and the thin and elongate mouthparts (proboscis), which include the labrum, lacinia, hypopharynx and labium. Maxillary palpi short, situated at the lower front margin of the head capsule, labellum not sucker-like.

Description

Small light-brown to blackish brown clinocerid empids. Head elongate, with vertical long movable mouth parts of different size, but of constant length in a certain taxon (fig. 1). Compound eyes ovoid, far apart on frons, densely haired. Head with 1 pair of ocellar bristles (oc), 1 pair vertical bristles (vb), and 5–8 postocular bristles (poc) in a single row. Thorax with 5–8 pairs of dorsocentral bristles (dc), distributed over the entire length of the scutum, sometimes with shorter bristles in between. Acrostichials (ac) absent to numerous, extending to the end of mesonotum, 1–2 humerals (h), 1 posthumeral (ph), 1 intraalar (ia) and 1 postalar (pa) bristle, sometimes missing. Scutellum with a pair of apical (ab) and 1–2 pairs of preapical (pab) scutellar bristles. Legs brown to light brown, with tarsal segments 2–4 of at least front legs of equal length. Claws and pulvilli large, empodium pulvilliform. Wing brownish translucent without stigma, wing venation variable. Medial crossvein (m — m) between m_2 and cua_1 present, or absent (coalescent or with an X-shaped fusion). Costal vein in at least a part of its extension anteriorly with two kinds of setae (strong setae and weak setulae), and a single basicostal bristle. Hypopygium large, with gonostyli of specific shape. Aedeagus 1.5–2 times longer than the elongate hypandrium. Cerci reduced in size, represented by small sclerites.

Description of new species***Roederiodes macedonicus* sp. n.**

Description: Head dark brown, with a vertical, elongate, light-brown proboscis 1/3 as long as head height. Compound eyes ovoid brownish black. Ocellar triangle with 1 pair of short oc; one pair of strong vb and 5 pairs of poc in a single row. Basal antennal segments subequal, weakly bristled, first flagellomere larger, ovate; style 2-segmented, a little longer than first flagellomere. Palpus with several short marginal setulae.

Thorax brown, scutum with 5 pairs of moderately strong, subequal dc and 4 pairs of ac in two setulose rows extending to the second pair of dc. One pair of strong h, one pair of ph and one pair of ia. Scutellum with a pair of strong apical and 1–2 pairs of weak preapical bristles.

Legs light brown, long and slender. Front legs with tarsal segments 2–4 of the same length, hind legs with second tarsomere 1.5 longer than the fourth.

Wing (fig. 2) brownish translucent, without stigma. Cell bm slightly shorter and narrower than the cell cup. Veins m₂ and cu_{a1} connected by a distinct m-m crossvein 4 times longer than the basal peduncle of m₂. Basal costal bristle of wing present, anterior wing margin with a few strong setae and numerous weak setulae.

Abdomen light brown. Male genitalia (figs 3–4) with a hypandrium narrower than gonocoxite. Gonocoxite triangular with basal margin slightly incurved, apical margin broad and rounded. Gonostylus bilobed, well developed, with a narrow and elongate vertical part, horizontal part broader and shorter than the vertical, in dorsal view slightly recurved, in lateral view with a blunt tip. Inner side of gonostylus (fig. 4) with numerous strong spines at the dorsal tip of the vertical part, horizontal part with numerous bristles. Cerci reduced in size, represented by distinct sclerites at the base of the gonostyli with bristles and hairs. Aedeagus elongate, flagellum more than half of the length of the basal part, distally bipartite, with a filose appendage.

Measurements: Body length: male, 2.4 mm, female, 2.5–2.8 mm. Wing length: male 2.5 mm, female 2.7–3.0 mm.

Relationships: A close relative of the following species, *R. montenegrinus* sp. n. (see discussion under latter species).

Etymology: The new species was found in Macedonia.

Material examined. Holotype, 1 ♂, MACEDONIA: stream 3 km south of Aldinci, Karadzica Mts., Dracevo, 1220 m a. s. l., 26.–30. VI. 1989, leg. Horvat and Krystufek, (UTM: EM 32) (SMNH), Paratypes 2 ♀ (same data as holotype) (SMNH).

***Roederiodes montenegrinus* sp. n.**

Description: Head dark brown, with a vertical, elongate proboscis 1/3 as long as head height. Compound eyes ovoid brownish black. Ocellar triangle with one pair of short oc, one pair of strong vb and five pairs of poc in a single row. Basal antennal segments subequal, weakly setose, first flagellomere ovate; style 2-segmented, a little longer than first flagellomere. Palpus with marginal setulae.

Thorax dark brown, scutum with five pairs of moderately strong dc of equal length. Three pairs of ac in two rows extending to the third pair of dc. One pair of small h, one pair of ph and one pair of ia. Scutellum with a pair of strong ab and 1–2 pairs of weak pab.

Legs dark brown, elongate. Front legs as in generic description, hind legs with second tarsomere as long as third and fourth tarsomere.

Wing brownish translucent, without stigma. Cell bm of approx. the same length as cell cup, veins m₂ and cu_{a1} connected by a distinct m-m crossvein 4 times longer than the basal peduncle of m₂. Costa basally wide, with a basicostal bristle.

Abdomen brown. Male genitalia (fig. 5–6) with hypandrium narrower than gonocoxite. Gonocoxite triangular, slightly incurved at basal margin. Gonostylus bilobed, well developed, with a thin and elongate vertical part. Horizontal part slightly longer than wide and clearly

shorter than the vertical, in dorsal view recurved, in lateral view with blunt incurved distal margin. Inner side of the gonostylus (fig. 6): vertical part with several spines on its distal half, horizontal part with a few wide-spaced bristles. Cerci setose, reduced in size, represented by small sclerites at the base of the gonostyli. Aedeagus long and slender, flagellum less than half the length of basal part, without specific features.

Measurements: Body length: male, 2.7–3.4 mm, female, 2.8–3.7 mm. Wing length: male, 2.5–3.3 mm, female, 2.7–3.2 mm.

Relationships and recognition: *R. macedonicus* sp. n. and *R. montenegrinus* sp. n. are closely related taxa to be judged from the similar shape of the genitalia, both occurring in the central Balkan area. Both are distinguished from the other European taxa by the V-shaped gonostyli. The differences between both species are found in the shape of the gonostyli and the aedeagus. The horizontal part of the gonostylus is elongate rectangular in *R. montenegrinus* and approximately quadrate in *R. macedonicus*. In addition, its hind margin is slightly depressed in *R. montenegrinus*, but is simply round in *R. macedonicus*. Furthermore, the flagellum of the aedeagus is thin and elongate and longer than half length of the basal part in *R. macedonicus*, but it is markedly wide and slightly shorter than half the length of the basal part in *R. montenegrinus*.

Etymology: The new species was found in Montenegro.

Material examined. Holotype, 1 ♂, MONTENEGRO, Sinjajevina Planina, Lipovo, spring stream Ropusica 1300 m a. s. l., 43° 60' N/17° 10' W, 10. VI. 1990, leg. R. Gerecke. Paratypes, 5 ♂, 5 ♀ together with holotype, (WAGC). Montenegro: 4 ♂, 4 ♀, Bjelasica Planina, spring below Lubnice, 900 m a. s. l. (42° 40' N/17° 26' W), 9. VI. 1990, leg. R. Gerecke (SMNH).

Roederiodes siveci sp. n.

Description: Head brown, with a vertical, elongate proboscis 1/3 as long as head height. Eyes ovoid, brownish. Ocellar triangle with one pair of short oc, one pair of strong vb and five pairs of subequal poc in a single row. Basal antennal segments subequal, weakly bristled, first flagellomere larger, ovate; style long, 2-segmented, almost twice as long as first flagellomere. Palpus with a few short marginal setulae.

Thorax brown, scutum with five pairs of equal dc, four pairs of ac in two rows extending to the second pair of dc, one pair of strong h, ph, ia and pa. Scutellum with one pair of strong ab and 1–2 pairs of weak ab.

Legs light brown. Front legs as in generic description, hind legs with second tarsomere 1.5 times longer than the fourth.

Wing (fig. 7) brownish translucent, without stigma. Cell bm shorter and wider than cell cup. Veins m₂ and cua₁ connected by a distinct m-m crossvein 3–4 times longer than the basal peduncle of m₂. Basicostal bristle of wing present, anterior wing margin with two different kinds of setae.

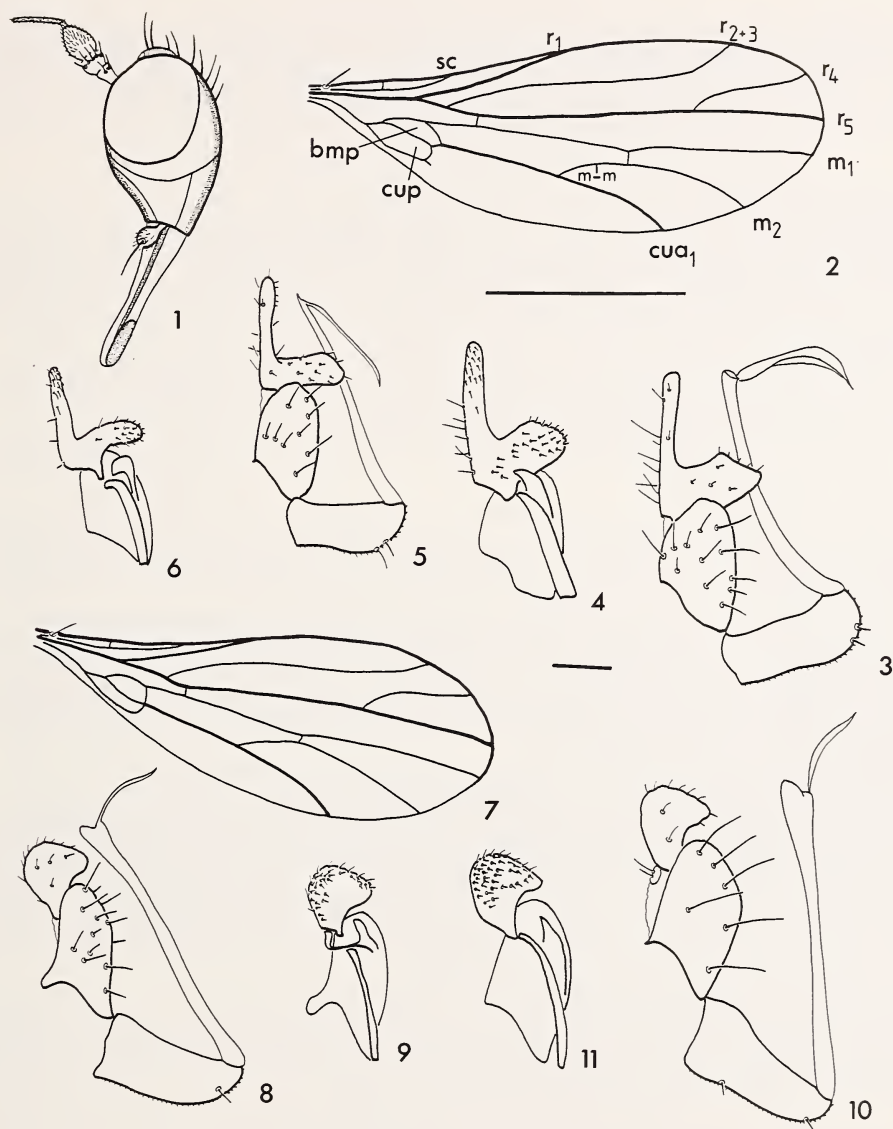
Abdomen brown. Male genitalia (fig. 8) large, hypandrium elongate, longer than gonocoxite. Gonocoxite triangular, basal margin almost straight, apical margin curved. Gonostylus simple, ovoid, small, with a short and blunt caudal extension. Inner side of the gonostylus (fig. 9) along the apical and dorsal margin with numerous spines. Cerci represented by small sclerites, setose. Aedeagus long, filament shorter than half of the length of the basal part.

Measurements: Body length: male, 2.6–3.3 mm, female, 2.7–2.9 mm. Wing length: male, 2.9–3.1 mm, female, 3.2–3.5 mm.

Relationships: The closest relative of the new species is *Roederiodes gerecke* sp. n. (see discussion under latter species).

Etymology: The new species is dedicated to Dr. I. Sivec, director of the Slovene Museum of Natural History, Ljubljana.

Material examined. Holotype, 1 ♂ GREECE: Etolia, Agia Soufia, Agrinio 28. IV. 1989. Paratypes all from GREECE, 2 ♂, 1 ♀ (same data as holotype) (SMNH). 3 ♂, 4 ♀, (same data as holotype) 24. IV. 1990 (SMNH). 2 ♂, 2 ♀, Etolia, 3 km N of Hani Lioliou, Agrinio, Panetoliko Mts., 24. IV. 1990, (SMNH). 9 ♂, 5 ♀, Etolia, Klepa, Panetoliko Mts. 25. IV. 1990



Figs 1–4: *Roederiodes macedonicus* sp. n.; 1 — head; 2 — wing, 3–4 genitalia, lateral outer (3) and inner (4) view. Figs 5–6: *Roederiodes montenegrinus* sp. n.; genitalia, lateral outer (5) and inner (6) view. Figs 7–9: *Roederiodes siveci* sp. n.; 7 — wing, 8–9 genitalia, lateral outer (8) and inner (9) view. Figs 10–11: *Roederiodes gereckeii* sp. n.; genitalia, lateral outer (10) and inner (11) view. Scales represent 1 mm (wings) and 0.1 mm (genitalia).

(WAGC). 1 ♂ Etolia, Koutsopanneika, Nafpaktos, 23. IV. 1990, (SMNH). 1 ♀, Peloponnisos, Kristalovrisi, Panahaiko Mts., 17. IV. 1990 (SMNH). 1 ♀ Peloponnisos, Kounaveika, Panahaiko Mts. 17. IV. 1990, (SMNH). 1 ♂, Peloponnisos, Lakomata, Erimanthos Mts. 18. IV. 1990, (SMNH). 2 ♂ Peloponnisos, Kalivia, Aroania Mts. 20. IV. 1990 (SMNH). 4 ♂, 4 ♀ Peloponnisos, 2 km N of Peristera, 22. IV. 1990 (WAGC). All material leg. Horvat and Sivec.

Roederiodes gerecki sp. n.

Description: Entire body dark brown. Head with an elongate vertical proboscis 1/3 as long as head height. Compound eyes ovoid, almost black. Ocellar triangle with one pair of oc, one pair of short vb and five pairs of subequal poc. Basal antennal segments subequal, weakly bristled, first flagellomere larger, ovate; style long, 2-segmented, slightly longer than first flagellomere.

Thorax almost black, scutum with five pairs of equal dc, three pairs of ac in two rows extending to the third pair of dc, one pair of strong h, ph, ia, and pa. Scutellum with a pair of strong apical and 1–2 pairs of weak preapical bristles.

Legs brown, front legs as in generic description, hind legs with second tarsal segment slightly longer than the fourth.

Wing brownish translucent, without stigma. Cell bm distinctly shorter and wider than cell cup. Veins m_2 and cua_1 separated by an $m-m$ crossvein, 4 times longer than the basal peduncle of m_2 . Basicostal bristle of wing present, anterior wing margin with two different kinds of setae.

Abdomen brown. Male genitalia (fig. 10) large, hypandrium elongate, clearly longer than gonocoxite. Gonocoxite triangular, rounded at upper margin, basal margin slightly incurved, apical margin round. Gonostylus simple, ovoid, small, with a sharp caudal tip. Nearly the entire inner surface of the gonostylus is covered with setae (fig. 11). Cerci small, sclerites with bristles, reduced in size. Aedeagus elongate, twice as long as hypandrium, filament approximately half as long as the basal part.

Measurements: Wing length: male, 2.9 mm. Body length: male, 3.1 mm.

Relationships and recognition: *R. siveci* sp. n. and *R. gerecki* sp. n. are close relatives, as indicated by the coloration and the chaetotaxy of the entire body, and by the similar shape of the genitalia. Both are distinguished from the other species described above by the simple gonostylus, a feature they share with *R. oldenbergi* (Engel), however, the gonostylus is longer than wide in *R. oldenbergi*, but wider than long in the new taxa. *R. siveci* and *R. gerecki* are distinguished by the different shape of the caudal extension of the gonostylus, with a sharp apex in *R. gerecki*, and a blunt apex in *R. siveci*.

Etymology: The new species is dedicated to Dr. R. Gerecke, scientist at the Zoologische Staatssammlung München, Germany.

Material examined. Holotype: 1 ♂, ITALY: Sardinia, stream above Giagone, 400 m a. s. l. (NL 08 19), 25. V. 1986, leg. R. Gerecke (WAGC).

Ecological observations

Specimens of *Roederiodes* are small in size, and thus may be easily overlooked. They inhabit mainly fast flowing streams, hygropetric zones and karstic springs. Riverbeds of the biotopes are usually dark, due to the rich content of organic matter and the sediment consists of gravel of different sizes. We found the flies among dead leaves and twigs in organic deposits on larger stones. If this organic debris is removed, some decimeters below we noticed the small swift flies. Being disturbed, they quickly jump on the water surface. After a while they fly up, stay in the air at a certain place for several seconds (like a helicopter) and then they return to the stones where they sit near the water surface. As predators they are feeding mainly on the

adults and larvae of black-flies (Diptera: Simuliidae, own observation and Peterson & Davies 1960). The type-localities of the species lie between 200–1300 m a. s. l., and the flight periods of the European species extend from April to August.

Key to male adults of the European species of *Roederiodes*

- 1 Scutum with 2 smaller bristles between the dc; more than 10 pairs ac extending length of scutum; wing with an elongate faint stigma *R. sorex*
- Scutum without smaller bristles between the dc; less than 5 pairs of ac; wing without stigma 2
- 2 5–6 dc; hypandrium as long as wide; aedeagus and flagellum short and stout; gonostylus circular, with a deep mediodorsal incision, medial veins coalescent (i. e. m-m crossvein meets furca m_1/m_2) *R. malickyi*
- 5 dc; hypandrium approx. twice as long as wide; aedeagus long and slender with a thin and elongate flagellum; medial crossvein present (i. e. furca m_1/m_2 proximal of the m-m crossvein) 3
- 3 Gonostylus simple, ovoid 4
- Gonostylus bilobed, V-or L-shaped 6
- 4 Proboscis 2/5 as long as the head height; hind legs with second tarsal segment twice as long as the fourth; gonostylus longer than wide *R. oldenbergi*
- Proboscis 1/3 as long as the head height, hind legs with second tarsal segment slightly longer than the fourth, gonostylus wider than long 5
- 5 Caudal margin of gonostylus with pointed projection; aedeagal filament appr. half length of the basal part *R. gerecke* sp. n.
- Caudal margin of gonostylus with blunt-tipped projection; aedeagal filament shorter than half length of the basal part *R. siveci* sp. n.
- 6 Horizontal part of the gonostylus elongate rectangular; aedeagal filament longer than half length of the basal part and with filose appendage *R. macedonicus* sp. n.
- Horizontal part of the gonostylus approx. quadrate; aedeagal filament shorter than half length of the basal part and without any appendage *R. montenegrinus* sp. n.

Remark: The type specimen of *R. longirostris* Frey, 1940, is badly damaged and thus the species is not included into the present key.

Checklist of the world species of *Roederiodes*

Palearctic Region

R. gerecke sp. n.
R. japonicus Saigusa, 1963
R. longirostris Frey, 1940
R. macedonicus sp. n.
R. malickyi Wagner, 1981
R. montenegrinus sp. n.
R. oldenbergi (Engel, 1918)
R. siveci sp. n.
R. sorex (Engel, 1918)

Nearctic Region

R. distinctus Chillcott, 1961, only female
R. juncus Coquillett, 1901 (type-species)
R. petersoni Chillcott, 1966
R. recurvatus Chillcott, 1961
R. retroversa Chillcott, 1961
R. vockerothi Chillcott, 1961
R. wirthi Chillcott, 1961

Neotropical Region

R. wiggins Wilder, 1981

Zusammenfassung

Eine kritische Durchsicht der europäischen Arten der Gattung *Roederiodes* Coquillett, 1901, ergab, daß *Clinocerella* Engel, 1918, die als Untergattung von *Wiedemannia* Zetterstedt, 1838, beschrieben wurde, ein Synonym von *Roederiodes* ist (syn. n.). Der von Engel genannte Unterschied zwischen beiden, *Clinocerella* sollte nur gleichmäßig große Borsten auf der Costalader besitzen, besteht nicht. Vier neue europäische Arten, *R. macedonicus* sp. n., *R. montenegrinus* sp. n., *R. siveci* sp. n. und *R. gerecke* sp. n. werden beschrieben, ihre Verwandtschaft untereinander wird diskutiert, und einige Beobachtungen zur Ökologie werden mitgeteilt. Ein Bestimmungsschlüssel für die Männchen der europäischen Arten und eine Checkliste für die bisher aus dieser Gattung beschriebenen Taxa wird vorgelegt.

Acknowledgements

The authors acknowledge the gift of specimens, collected by Dr. R. Gerecke (Zoologische Staatsammlung München, Germany) in various parts of South-Eastern Europe. We also thank Mr. W. Schacht (Zoologische Staatsammlung München) for the loan of the type specimen of *Clinocerella sorex*. We sincerely thank Dr. B. Sinclair (Carlton University, Ottawa, Canada) for the critical revision of an earlier version of the manuscript and for linguistic advice.

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Zeitschrift/Journal: [Bonn zoological Bulletin - früher Bonner Zoologische Beiträge.](#)

Jahr/Year: 1993

Band/Volume: [44](#)

Autor(en)/Author(s): Wagner Rüdiger, Horvat Bogdan

Artikel/Article: [The genus *Roederiodes* Coquillett, 1901 \(Diptera, Empididae: Clinocerinae\) in Europe, with descriptions of four new species 33-40](#)